

Snowball Earth and GCM simulation

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Numerical simulation of snowball Earth, using out-of-date supercomputer program has been performed recently in USA, France and Germany. It seems to be difficult to reconstruct Snowball state by their simulation, while freezing more than 55% of ocean. If continents are gathered along the equatorial region such as Rodinia in the case of Sturtian and Marinoan Snowball Earth in Neoproterozoic, total surface irradiance (TSI) seems plausible to be 95% of present day and CO₂ level as same as today. However, if the atmospheric CO₂ is 2-6 times more than today, Snowball state cannot appear (Voigt et al., 2011). More realistic CO₂ concentration of Neoproterozoic Earth was 20-50 times more than today. In addition, the temperature fluctuation of Snowball Earth period, from Sturtian to Marinoan, was -40 °C to +40 °C and vice versa within a short period <10 m.y. which seem to be impossible because input and output of CO₂ by plate tectonics usually takes time more than several hundreds of millions years.

GCM simulation exaggerates positive feedback of CO₂ too much. It is time to remodel GCM, considering the amount of clouds and its effect.